

Montana Department of Agriculture 2007 Pest Survey: Final Report

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Introduction

Montana's big sky, countless rivers and open lands attract millions of visitors each year. These people come from around the country and world to spend time in this beautiful landscape. With so many visitors from out of state, the potential for the introduction and spread of invasive insects is not uncommon. The insects can be spread through the transportation of egg mass, larvae or the insect itself. Hitchhiking on vehicles, campers, bikes, camping chairs, firewood, etc... are all pathways in which these insects can be spread. An introduction of an exotic insect can be devastating to the ecosystem, tree nurseries and for the esthetics of the natural surroundings. Often eradication of these invasive pests can be labor intensive and cost the state thousands of dollars.

This summer my internship was setting insect traps for the state's Cooperative Agricultural Pest Survey program (CAPS). Throughout the summer fellow intern Alissa Rafferty and I set over two hundred sticky Pheromone traps for *Rhyacionia buoliana* (European pine shoot moth or EPSM) and *Lymantria dispar* (gypsy moth or GM). As well as trapping for these two moths, we also set 60 traps for *Dendrolimus superans sibiricus* Tschetverikov (Siberian Silk Moth or SSM) and trapped for *Eudocima materna* (Fruit-piercing Moth or FPM) using a black light trap. The GM and EPSM traps use a pheromone, which lures the moth into the trap and catches it on the sticky side of the trap. All traps were set in coniferous trees along roadsides. Trapping was done in ten counties west of the continental divide excluding Deer Lodge, Silver Bow, and Madison.



Fig 1: Male EPSM. www.acgov.org

EPSM is a pest for a majority of all coniferous species, especially the Austrian, red and Scotch pine trees. The feeding larvae cause damage after the eggs have hatched. Damage to trees can include; distorted growth, damage or death of buds and shoots, and needle damage. The surviving buds will end up growing into a witches broom shape or an S curve (as seen in Fig. 2). The damage caused by these trees can greatly affect nursery stock because the shape and size of the infected tree is changed.



Figure 2: S shaped damage caused by EPSM. www.pierroton.inra.fr

EPSM was first introduced onto Long Island New York in 1914. The importation of infested nursery stock from Holland is most likely where the pest came from. The repeated importation of these infested trees led to the spread of the pest into nine states within a year. Today EPSM is distributed in the northeastern states west to Minnesota as well as Oregon, Washington and southern Canada. Pine nurseries as well as Christmas tree plantations are most commonly affected. EPSM has been found in Montana but with no major populations. The CAPS program is necessary to survey for and detect EPSM in the state.

Methods

For the first month of our CAPS internship, Alissa and I worked on a labor-intensive Plum Pox Virus (PPV) survey in Sanders and Lake Counties. Because of this, we were only able to set traps for one day a week for the first month, which limited our trapping. We were each able to place 206 insect traps for EPSM and GM. We also were able to set out 59 modified milk carton traps for SSM. All three of the traps were placed in the same vicinity of each other, per site.

Traps were assembled prior to heading out for a day of trapping. This saved time, energy and patience. The EPSM traps are not as convenient to make in a Ford Taurus as the floor of a hotel room.

We trapped along major roads in all but three counties west of the continental divide. All EPSM traps were placed in *Pinus* trees, which was sometimes limited because of the lack of vegetation. The wire extension was wrapped around the branch, and if not secure, a zip tie was added to secure the trap. Traps were set every 2-4 miles to the best of our abilities, and marked on a state atlas for our record. Each trap was baited using a small pheromone which was placed in the middle of the sticky part of the trap.

A data sheet accompanied every trap. Trap number (ex. MTEPSM200WDS001), date,

county, GPS location, as well as a verbal description and hand drawn map were produced for each and every trap. GPS coordinates were taken and saved using the hand held GPS unit. Coordinates were downloaded weekly and sent to the CAPS coordinator for recording.

Because of the limited time in the beginning of the summer to set traps, we were unable to check a majority of the traps that we set. EPSM traps in Missoula, Lake, Flathead, and Mineral counties were checked, replaced, and sent to the state entomologist Dr. Patricia Denke for analysis.

Results

Of the traps we were able to check in our time with the state, no EPSM were found. Ironically enough one of the EPSM traps did catch a Japanese Beatle, which was, located North of Finley Point on the east side of Flathead Lake. This freak occurrence warned the state about a potential out-break of another invasive insect that can be potentially devastating to the ecosystem. An intensive trapping scheme was placed in that area within two days of the identification.

Conclusions

I have been waiting for an opportunity to work out west since I first visited Glacier National Park a couple years ago. This internship not only gave me excellent fieldwork experience but it gave me an excuse to live in Missoula for an entire summer. The benefit of this job is that you truly see every county and road west of the continental divide. From Libby all the way down to Beaverhead. The scenery west of the mountains is truly breathtaking wherever you go. I am completely comfortable traveling anywhere in the state, and the best part is by the end of the summer I didn't need a map to get there. I learned to be flexible and to improvise. A lot of the time, especially in the beginning of the summer when I had questions and no cell phone service, I had to deal with my problems on my own. I learned a lot along the way and here are some of my thoughts for the next year's interns. If you are that person please read it, because it will happen to you.

Things/mistakes I made that you shouldn't next year.

If you have as bad a sense of direction as I do, look at your map before you start to drive. Know what general directions you are suppose to be going. Heck, buy a compass; it will really make a difference.

If you don't already have a nice pair of polarized glasses, get a pair. It will be the best investment you will make. Many times you are driving in early morning and dusk with tough sunlight, combine that with the bug guts on your windshield, and you won't be able to see a thing.

Take time in the morning to make sure you have ALL the potential items that you might need for the week. If you think you might need it, you probably will. Don't forget your GPS because you can't do anything without it, I learned that the hard way.

Stay organized! Use the “Mobile” office they give you. Make sure you keep any and all receipts. Have a place for everything in the car and keep it there, especially sharpies and pens.

An awesome thing about this job is that you make your own hours! If you’re not a morning person get up at 10am and work late. Definitely work 10-hour days/4days a week. This gives you a lot of opportunity to go play in the outdoors for three days and not just two.

Always gas up at any place you can. Even if you think you have enough gas, think again. Many times you will drive for 100 miles with nothing. If you are traveling to Libby, fuel up in Kalispell. We rolled into Libby on fumes one time...wasn’t a fun experience.

If you are spending time in Plains, MT, stay at the Dew Duck Inn (have to make reservations in advance though). It is significantly nicer than the Crossroads Inn. Bengies and Stage Line Pizza is the best food in Plains. Good ice cream at the Circle. Subway is about the only place for lunch.

83 is the easiest road to trap on. 90 was the least convenient. I would try to avoid major highways for safety and trapping convenience. Find roads that travel through national forests because they have nice trees.

Be careful while setting traps, it may not appear dangerous but it can be. I ran into a tree branch and punctured my scalp and broke a piece of wood off under the skin. Seeley-swan medical center did a great job giving me stitches.

Always bring a couple bottles of water, towel and bathing suit. You never know.

Always wear pants no matter how hot it is out. The one day I didn’t I was cut up and had rashes for days. I would also recommend wearing a hat as well.

As tedious as this job may seem at times, you have to remember that it does mean a lot to the state. These traps are important to put out every summer to protect the state’s natural resources. I am honored to have been apart of the CAPS internship and had a blast doing it. My job felt like a vacation most of the time and I can’t wait to come back and live in Montana.

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Montana Department of Agriculture 2007 Pest Survey
Internship Final Report
Alissa Rafferty
August 2, 2007

INTRODUCTION

As an intern for the Montana State Department of Agriculture I have spent the summer conducting and monitoring several plant pest surveys throughout the state, west of the continental divide. Working as a team, both fellow intern Walter Scherer and I conducted surveys for one plant virus, and four plant pest species. Two of these species were exotic moths known as the Siberian silk moth (SSM), and the fruit piercing moth (FPM), while the other two plant pests were the gypsy moth (GM) and the European pine shoot moth (EPSM)

All of these plant pests pose a serious threat to Montana's vital agricultural and nursery industries, as well as the natural ecosystems and landscapes they inhabit. I was a part of the cooperative agricultural pest survey (CAPS), a combined effort between federal and state agencies to detect early introductions and infestations of pest species by placing and monitoring insect traps in areas of risk throughout the state. As each pest differs in both history and habitat, different survey methods of the four pest species were carried out under the department's guidelines.

Since the majority of our survey time revolved around the GM and EPSM, my main objective in this report will be to highlight the GM material, while providing a general overview of the plant virus survey and the two exotic moth surveys we also conducted. Since Walter and I were able to work as a pair, his report will cover the EPSM information.

GYPSY MOTH:

In areas where GM populations can reach high densities, these insects can severely damage natural ecosystems by completely defoliating host trees. During the actual moth stage the insect causes little harm, but the survival of future generations can be deadly as the larvae are responsible for destroying several tree species. Gypsy Moths have defoliated up to 13 million acres of trees in one season as thousands of eggs hatch each year. These moths generally occur in temperate, natural, and artificial forests primary among deciduous trees and shrubs. Unlike European regions, GM in North America has no natural predators and can thus survive in high numbers and be very difficult to eradicate. Since this pest is most often introduced by human transportation and recreation activities, regulation and early detection is important in preventing the spread of such an infestation. It is important for residents to be familiar with such pests and inspect outdoor household items when traveling across the state or country. Although the GM was first found in the eastern United States, the spread of this pest is a possibility, as it has caused isolated incidences in the west before.



Figure 1. Gypsy moth adult male and female, and larvae.
wihort.uwex.edu/Phenology/GypsyMoth

PLUM POX VIRUS:

The plant virus survey I took part in involved five weeks of leaf sampling in Plains, as well as various cherry orchards in Lake County. The goal of this project was to provide a thorough and representative sample of the entire area in order to test the plants for the virus known as plum pox. This virus can be detrimental to *Prunus* species and is thus very threatening to Montana's nursery industries. It is crucial to certify particular nurseries virus-free before their products are shipped across the country and internationally.



Figure 2. *Prunus* trees and fruit infected with plum pox virus.
www.ipm.msu.edu/plumpox.htm

EXOTIC MOTHS:

The exotic moth trapping involved the use of a black light that was set in cherry and apple orchards overnight to catch any suspicious moths and pests in the area. The other trap known as the modified milk carton was placed near the GM and EPSM locations. Although these exotic moths are not in western Montana, the potential introduction from foreign countries would be very harmful to the state's fruit, lumber, and nursery industries.

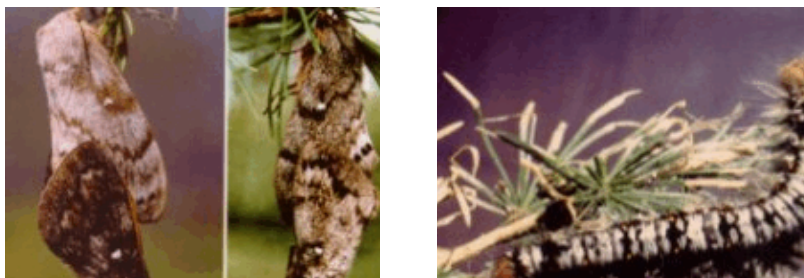


Figure 3. Siberian silk moths and larvae.
www.inspection.gc.ca/.../surv/data/densupe.shtml



Figure 4. Fruit piercing moth.

www2.dpi.qld.gov.au/horticulture/5541.html

METHODS

Our primary procedure for the GM survey involved constructing 205 cardboard traps with unique pheromone strips inside intended to attract the adult males. Traps were placed between two to five miles apart where possible, depending on the surrounding area and tree species. Traps were placed in deciduous trees and shrubs, while resorting to coniferous trees when deciduous were inaccessible.

The counties surveyed west of the continental divide included Lincoln, Flathead, Sanders, Lake, Mineral, Missoula, Powell, Ravalli, Granite, Deer Lodge, and Beaverhead. Certain areas that are at a higher risk or more appropriate for trapping were trapped more heavily than others. For example the Flathead, Lincoln, and Lake County regions were trapped much more heavily than the southern counties such as Deer Lodge and Beaverhead.

The traps that have been checked thus far include Flathead, Lake, Mineral, Missoula, and Ravalli Counties. All EPSM and suspect gypsy moth traps were sent for the state entomologist for a more thorough examining process. With Walter and I working as a team we were able to place the GM and EPSM traps in relatively the same locations, while also setting the Siberian Silk Moth traps nearby.

We completed a total of 59 SSM traps, and conducted the black light trapping in 10 different orchards.

RESULTS

In traps that have been checked thus far, we have found no GM or EPSM. There was however a different pest known as the Japanese beetle that was found in an EPSM trap located in Lake County. This finding has led to immediate action and surveillance of the area along with further trapping for this pest.

The leaf samples for the plant virus also turned out negative allowing for the transportation of nursery stock across the border into Canada.

Although black light traps that were placed in various orchards certainly caught a lot of insects, none of them were found to be harmful to the orchards' operations.

The Siberian Silk Moth traps that were placed along side the GM and EPSM have yet to be checked but a follow up is in the planning.

CONCLUSION

Although it may seem that after a summer of work we came up empty handed, the fact that we didn't find any of the target moths we were specifically trapping for is very good news for the state's forests and industries. By keeping an intensive trapping and monitoring system in place we can ensure that the health and prosperity of these important systems will be protected for future generations against pest infestations. The Japanese beetle finding is the only alarming news of the summer, and with further investigations this will hopefully turn out to be only an isolated case.

My personal experience with this internship over the summer has been very exciting and enjoyable. Coming out West from the East coast for my first time was an incredible experience in itself, and having the opportunity to travel all over the western half of the state was fantastic. The flexible scheduling the department allowed us enabled us to enjoy the areas we traveled and plan our own trips accordingly.

Below are a few things we learned over the course of the summer that may be helpful to future interns:

- It is often difficult to predict which roads will be good for trapping but there didn't seem to be as much of a problem in the northern counties as there was in the south. Use a map and try to hit all the roads located in national forests.
- If you are going to be spending a month in Plains, Montana, choose the Dew Duck Inn over the Crossroads despite what you may think of the name.
- Although usually impossible to find on busy highways like interstate 90, the use of pull offs on the side of the road make trapping much safer and smoother as you search for a site.
- Speaking of safety, try to avoid colliding with a tree as Walter did because hospitals and medical centers can be hard to find in western Montana and you may be forced to sit in a waiting room for hours.
- If at all possible, spend a few days constructing traps prior to setting them as it will save a lot of frustration, time, and space for the car rides.
- If you have the choice, work in the cherry orchards along Flathead Lake, particularly the organic orchards where you won't have to worry about chemicals. It is also best if you work near harvest time when the fruit is ripe, around mid July.
- Use the odometer at each stop so you know exactly how far apart the traps are. This makes returning to them for a follow up much easier than driving 30mph on the highway aimlessly searching for your trap.
- Finally, if you're going to travel as a pair as we did, make sure you like the person as you will be spending the entire summer together, often trapped in the same car. Despite the potential for an extremely long summer, luckily for us this didn't seem to be a problem. As this was my first time out here, it is much appreciated that the department allowed us to pair up and work as we did. We had a wonderful summer exploring Montana and learning all about the state's beautiful natural, cultural, and agricultural landscapes. This certainly won't be my last summer spent enjoying the wonderful state of Montana!

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Montana 2007

Cereal Leaf Beetles

INTRODUCTION

As I took the first step and applied for this position, I found myself to be very unprepared for what was going to be expected of me. I had known some of what was required, but not all of the details.

Upon waking up Monday morning, I found myself to be anxious, excited, and nervous all at the same time. When I arrived at work, I was introduced to everyone. The people that I met were very friendly and willing to help in anyway that they could. They all said that if I have any questions don't be afraid to ask. This is because they wanted to make sure that I understand what I would be doing, and to clarify any doubts or concerns.

As the day continued to go by, my supervisor reiterated that if I had any questions to make sure that I don't hesitate to ask. This made me feel more comfortable, and assisted in easing my anxiety. It was very important for me to ask questions, as it made it easier to understand the technical aspects of my position and the responsibilities I would be performing.

I have learned the process and procedures for developing a published scientific report based on my work this summer, and determining scientific conclusions based on observed and determined facts.

The Cereal Leaf Beetle (CLB), *Oulema melanopus* is a dangerous pest that consumes many

different grain plants such as wheat, barley, oats, corn and other small grains. Their favorite is oats and barley and they choose the spring planted grains over the winter planted grains.

The CLB has become a serious pest of small grains in the Mid-Atlantic region of the United States. (5) The beetles had originally come from Europe and Asia. It was first found in Michigan in 1962; from there it spread to the other neighboring states. Once it was found, a large-scale eradication program was conducted by the U.S. Department of Agriculture (USDA) and cooperating states from 1963 to 1969. It was unsuccessful. (1)

From 1964 to 1970, USDA's Agricultural Research Service imported some of the CLB's natural enemies to keep the beetles from spreading further. By the early 1970's there were four species of natural enemies that were found and established in Michigan and Indiana. As a result of this program, the natural enemies CLB's were spread, with the parasitoids being released in many sites, and the CLB populations had decreased substantially (Footnote #1).

CEREAL LEAF BEETLE BIOLOGY

Figure 1 CLB Eggs on leaf



Credited to Conrad Berube
Crop Management

The eggs of a CLB are yellowish when they are first laid and they darken before hatching. I was astonished to see how small they were in comparison to the beetle. The eggs are laid on the upper surface of the plant leaf, and are about the size of a pinhead. (figure1).

The larval stage is the most damaging stage of this particular insect; even though the adults will feed on the plants also. They graze on the upper leaf surface as they feed. The smaller larvae will feed mostly between the leaf veins, this results' in long, narrow slits in the leaves. The larvae have a black head and

yellow body and sometimes the yellow color is not always visible. This is because they often cover themselves with their own fecal material, which can be rubbed off onto your clothing or your skin. (figure2)

The eggs will normally hatch in 5 days the larvae feed on the leaves for about 10 days; at which time they will move into the soil to pupate, emerging as beetles in 2 to 3 weeks. After feeding for about 2 weeks or so on cereal crops, the adult beetles will go into summer hibernation. Later on they will seek out shelter to pass the winter.

I often had a hard time trying to find the larvae, due to their habit of covering themselves in their own fecal material; this appeared like droplets of dark colored mud. I put one of the larvae into a glass vial it still looked like mud.

Adult CLB's are $3/16^{\text{th}}$ of an inch long and they have a metallic blue head and wing covers, with a red pronotum (neck) and orange-yellow legs. (2) (Figure 6)

Figure 2 Early instar CLB



Photo by April Wabeke

Figure 3 Soft winged flower beetle.



There are several look-a-likes to CLB adults. A beetle called the soft winged flower beetle is a beetle that looks very similar to the CLB but it has a black dot on its head. (Figure 3)

Another look-a-like is called a long horned beetle. They look similar and this can be confusing, but if you look carefully you will notice that they are thinner. They are also longer than the CLB's. These beetles don't have the blue iridescence on their bodies. (Figure 4).

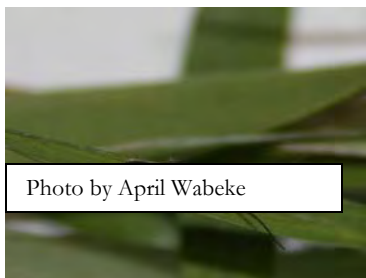


Photo by April Wabeke

Figure 6 Cereal Leaf Beetle Adult



Credited to Conrad Berube

grasses.

Damage from CLB's is very apparent, as the tips of the leaves of the plants turn a whitish color, from where the beetle had consumed the chlorophyll.

"The beetles consume the chlorophyll containing mesophyll cells, leaving the translucent lower leaf cuticle intact."(1). (figure 5)

Extensive damage caused by these insects looks frosted. These particular beetles do not like hot temperatures and they preferred cool moist areas. CLB's not only like wheat, barley, oats, and new corn shoots, but they are also found on rye, millet, rice, and many other types of wild



Figure 5 Leaf Damage

Credited to Conrad Berube

BIOCONTROL

There are four species of natural enemies of CLB that help control them in most of their range. All are parasitic Hymenoptera which are distant cousins to ants, honeybees, and wasps. One particular species, called *Anaphes flavipes* injects its eggs into the CLB eggs.

"When the parasite's eggs hatch, the young develop within the beetle eggs, devouring them as they grow." (1)

The other three species are *Diapars temporalis*, *Lemophagus curtus*, and *Tetrastichus julis*; they lay their eggs within the developing CLB larvae. After their eggs hatch, the parasitoid feed within the CLB larvae, destroying them. They are called parasitoids because they totally destroy their host. Some people even call them predators! (1)

METHODS

The best way to catch these insects is to use a sweep net. To catch these beetles, sweep along the edge of the field, using wide sweeping motions encompassing about 180 degrees in each sweep. This provides a wider angle to catch more beetles. As the sweeping motion is being continued, walk along the edge of the field; one motion to the left is considered one sweep, and then come back to the right for the second sweep. Keep doing this until you get to 100 sweeps; make sure to keep track of how many sweeps you have done! Once this task is done put them into a bag with some of

their food, and store them in a cooler place or the refrigerator.

As I was out in the field trying to locate the beetles by myself, I was uncertain as to exactly what the beetles would look like. While pictures are useful, they are not always helpful because they are not usually taken in the best conditions. The pictures may not always reflect what you are faced with while in the field. Some of the pictures may also become unclear and blurry, or were enlarged and became distorted. This may cause one to think that the insects are actually much larger than they really are. But when I finally found my first CLB larvae, I had to call the Entomologist and send a picture to find out if I had found what I was actually looking for. It was determined that it was exactly what I was supposed to be looking for. I was very proud and excited that I had been successful in locating larvae of the CLB!!!

I continued my search for these beetles, which was often very difficult. This was due to the lack of locating any beetles or larvae. It was as though I was not being observant enough. Then I came to an oat field in Flathead County MT. When I bent down to take a look at the leaves, I found some CLB eggs.

RESULTS

This job has taught me many skills that will be useful in life, increasing my knowledge and appreciation of basic scientific processes like insect identification and collection of samples. This included, identifying the site to take the sample, the collection of samples, recording the sample date, and labeling the samples correctly. It has also broadened my knowledge of the potential regulatory impact of my findings. This survey will be used to assist in determining where there are infestations of CLB's in the State of Montana. The results of my findings will determine if and when there will be a response to control this pest.

An additional benefit of this job was to increase my mapping skills. This included identifying, on paper, specific sites where the samples were collected; including as much detail as possible, allowing someone else to potentially follow up based on my findings.

A third benefit was to increase my scientific knowledge of computerized mapping systems including GPS software and hardware to record sample site locations. This will assist others in follow up if other actions are required. This will result in saving time relocating the areas that might be treated or re-visited for follow up surveys.

I have also learned to double check and ensure that I have appropriate materials and supplies that are necessary for a successful survey of the fields, where to park the car while sampling, for safety purposes and ease of entering the fields, with a clear egress from the fields, and determining that the GPS unit is properly charged and functioning. This has assisted in planning ahead.

As I worked on this survey, I had to rely on myself a great deal. I had to travel long distances in areas that were totally unfamiliar to me. I truly enjoyed traveling once I got used to it. I would have to find some fields that I thought were susceptible to CLB's. Once I had finished for the day, I had to find my way back into town. Finding my way around by myself proved to me that I was able to accomplish something that I had at first thought impossible.

As I continued my search for the CLB; I discovered that they liked the younger plants more than they liked the older, taller plants. As I was out trying to find these beetles, I started to know

what the damage looked like. When there was more humidity, I was able to find a lot more of the CLB larvae and adults. As I continued doing this survey I also observed that there seemed to be some damage on some other crops as well. I was able to determine, through close observation that they appeared to like the young corn as well.

We found *T.julis* in CLB larvae. In Madison and Beaverhead counties a total of 94 of the *T. julis* were found inside 19 CLB larvae. In Yellowstone County there was a total of 50 *T. julis* larvae found in 35 CLB larvae. In Broadwater County, there were 12 *T. julis* larvae found inside 2 CLB larvae.

There have been a total of 29 counties in Montana that were tested for CLB adults and larva and only 5 counties had tested positive, they were Madison, Broadwater, Beaverhead, Yellowstone, and Treasure counties. In Madison and Beaverhead counties there were 16 adult CLB found and 19 larvae found. In Broadwater County MT only 2 CLB larvae were found, in Yellowstone County only 35 CLB larvae were found, and in Treasure county 2 CLB larvae were found.

Table 1 : Summary of results of cereal leaf beetle sampling in 5 Montana counties

County	Cereal leaf beetle adults	Cereal leaf beetle larvae
Beaverhead	16	19
Broadwater	0	2
Madison	16	19
Yellowstone	0	35
Treasure	0	2
Total	32	77

CONCLUSION

It has been determined that there has been a problem with the CLB, and the damage that it does to the crops in Montana, since it was first discovered in 1998. However, we have to constantly ask these questions about the dynamics of CLB in Montana's cereal crops and the regions that they grow in. Are the CLB populations increasing? Are these populations approaching densities that may cause a loss of crops? Are CLB moving into new counties or onto new hosts? Because this insect has quarantine significance, these are vital questions.

Based on the samples that were obtained this year, I have concluded that they have not increased significantly in fact, the CLB numbers that are currently available for this year (2007) are far below the threshold that would be needed to cause economic loss to the farmers.

Weather plays a very important role in the prevalence of CLB's, and as this year was very hot and dry, it affected the numbers of CLB's. This was determined by obtaining a report from the MSU extension service, which stated in their Degree Day Predictions, "The base temperature for CLB is 44.6 degrees F, the lowest temperature at which biological activity of this insect occurs." This same report states that based on temperature calculations in Montana and careful observation of adult cereal leaf beetle, activity typically begins when 176 degree days have been accumulated.

(Degree Day formula that is used: (daily minimum temp+daily maximum temp)/2}-44.6=degree day.

Degree days since Jan. 1 (44.6 degree F)	CLB Stage	Monitoring Comments
176	Early Adult Activity	Monitor for Adult Activity
253	First Egg Lay	Monitor for eggs and larvae

"The first CLB eggs have been found when 253 degree days have accumulated. The calendar date will vary with temperatures and locations around the state." (4) The combination of a lower temperature about 9.0 degrees Celsius and also having warm spring weather enhances CLB's drastically. This then results in a more rapid destruction to the flag leaves by the fourth instar larvae stage, during at which time anthesis and milk development is going on. (5)

When considering the economic thresholds, consider the market price and costs of controls when making treatment decisions. Before the flag leaf emerges, treatment is warranted when plant samples average three (3) or more eggs and/or larvae per plant (tillering stages). Once a flag leaf is present the threshold drops to one (1) or more larva per flag leaf.

"Pest management recommends prescribed insecticide application when infestations of one (1) larvae per flag leaf were encountered in winter wheat or two (2) per flag leaf in oats and barley." (5)

By trying to eradicate the CLB, delaying the treatment until at least 25% of the eggs have hatched and the larvae have emerged before making a spray application. By doing this it ensures that conditions are more favorable for egg hatch and a larval population to decrease in size. CLB larvae are the target population that would be sprayed with insecticide, killing most of them off. (4)

"Pesticide applications to control the CLB have increased each year in Montana, from 1990 to 1997. Since that time, cereal leaf beetle populations have only reached economic levels in localized regions. Monitoring will help you decided whether cereal leaf beetle treatment is warranted." (4)

Consult the high plains IPM guide on the web at <http://highplainsipm.org> or for more information on chemical control, contact your local MSU Extension agent.

When checking for these beetles I was approached by several farmers who would inquire about CLB pesticides. Some of them had stated to me, that there were pesticides that had been tried and were not effective for eradicating CLB's. They then requested from me, any possible solutions

that would be useful in eradicating the CLB's. I informed them that parasitoids, (other insects that were "enemies" to the CLB) were the only solution for the time being.

When I first began this job, I had no idea whatsoever what a Cereal Leaf Beetle was, let alone what one looked like. However, while performing my job duties, I finally observed what the CLB was and I was amazed at how small it was. I learned what amount of damage a CLB was capable of doing. It also taught me that insects that are not kept under control can do massive damage. I understood that there are destructive insects and that they can do damage to plant life and vegetation. However, I didn't really understand the extent of the damage that an evasive insect can do. I have learned so much while performing my job responsibilities; I can't put it all down in words. Suffice it to say, my experience this summer has and always will be invaluable to me and my future.

I was so happy to receive this opportunity to work for the department of agriculture. I never thought that I would be provided the chance, and now that I have, it will remain a very important part of my resume. I met some very wonderful people who showed me what patience is really all about. They were wonderful to work with, and I hope that I will have a chance to do so again. Thank you very much, for such a wonderful opportunity. I was also very excited to travel to places that I had never been to before.

This report respectfully submitted by:

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